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PROBLEMS OF POPULATION.

IT is scarcely necessary to call attention to the fundamental truth that the prosperity of a country depends upon its resources and its population. But there is some occasion to emphasize that of the two, population is the more important. In tropical agriculture this is tantamount to saying that man is more important than soil fertility; that in all these effusive and reiterated utterances on the magnitude of a country's untapped resources there lies, in the background something sinister, something that is at present inimical to human health and happiness. There is no use in shutting our eyes to the fact and this is appreciated by Mr. F. A. W. Gisborne who, in a recent issue of the "Edinburgh Review" has challenged the view that the whole of the Australian continent is suitable for white settlement. Mr. Gisborne, himself an Australian, argues that portions of the Northern Territory are essentially tropical in character and can only be cultivated with the aid of coloured labour. He says the white cane cutters could not live permanently in the sugar region. Every year after crop they must return to the colder south; that European settlement is not practicable. He also argues that the protection given by the Commonwealth Government to the Queensland sugar industry to pay their high labour costs involves a very serious injury to the fruit growers in other parts of the Commonwealth, because it handicaps the local manufacture of jam. Mr. Gisborne's article has, of course, provoked protests, some of which are to appear in the "Edinburgh Review" this coming summer. The point is, why is Queensland so under-populated and devoid of tropical or sub-tropical races of people? The principal reason for this is known to everybody. Queensland's resources are deliberately sacrificed for an ideal. The Australians who have colonised and developed Australia are entitled to this ideal; and there for the present the matter ends. But in two other tropical places of the British Empire British Guiana and British Honduras, which stand out equally prominently with Queensland in the matter of under-population immediate causes are of a different in fact of an entirely opposite character. In British Guiana which is as large as Great Britain and has only 300,000 people (three per square mile) there is the demand for tropical races but there is no supply. Sir Wilfred Collet, the late Governor has just given what are in his opinion, the reasons. Summarised they are these: firstly, that natural increase in population has been prevented by the large proportion of men and very small proportion of women that came into British Guiana during the recent era of Indian Immigration; secondly, the return of immigrants to India; and thirdly the dislike which many natives of the West Indian Islands have for the flat coastal conditions of Guiana with the result that these people eventually return to the native islands. Sir Wilfred Collet says that he believes that scarcity of population has little to do with unhealthiness of climate. The Report of the West Indian Medical Conference in 1921 does not exactly support this belief though this need not in any way affect the inherent truth of the reasons adduced by Sir Wilfred Collet. After all it should be a matter of statistics, and there should be little need for argument or opinion. The interesting point is the human psychological factor in Sir Wilfred Collet's reasons. Such factors undoubtedly play a great part in population problems. In British Honduras which is the size of Wales with 5 people to the square mile the paucity of population is largely due to the unattractive conditions in regard to settlement,

which were described in Professor Dunlop's Report on the economic and natural conditions of the Colony in 1920. The Colony has no large agricultural industries employing labour or organization to encourage small cultivators. Capital is concentrated on forestry or rather forest industry. British Guiana is infinitely better off than her smaller sister. But whatever relative conditions may be in under-populated tropical countries "settlement" is the line to take. And reverting to Australia her new policy of European "group" settlement in the western parts might well be studied carefully by tropical administrators. In this system British settlers are chosen from the same county in England and settled together in Australia as the nucleus to form a village. Farm labourers, a retired sergeant-major, a butcher, a baker, a farmer or two are picked with their wives and settled altogether on a large block of land. One can conceive this community evolving in Adam Smith-like fashion from rough farms where so to speak each person takes in the other's washing, up through sociological stages, first the village and its adjoining farms then into a parish with its town and own municipal control, until the growth merges into other evolving group centres until finally the whole territory becomes completely carpeted with farms and towns with people exhibiting different inherent forms of genius and a common stock of traditions and racial instincts. To some extent this is actually happening in Western Australia. We are not able to say it could so easily be done in the tropics, for Mr. Chinaman comes along and makes a better, or more successful butcher and baker than his most expert East Indian confrère. But the idea is worth noting, and whatever else is done on not done in under-populated countries, the Government will fail to remedy things if it shuts its eyes to the fundamental importance of hygiene and sanitation as the primary consideration.

TRINIDAD CACAO.

At the instance of Mr. D. Majani, the prominent merchant of Port-of-Spain, an interesting and important meeting took place in the Economics Department of the Imperial College of Tropical Agriculture on March 6, when Mr. J. Walker the famous chocolate manufacturer of Boston was kind enough not only to give his views but to answer a great number of questions in connection with the uses and value of Trinidad cacao. Accompanying Mr. Walker were the well-known Wall Street cacao brokers Mr. Joseph Marcone and Mr. Emil Pick. Amongst those of the College who were present were Professors Ballou, Ashby, Hardy, Dunlop and Dr. Withycombe, Mr. Cheesman and Mr. Turner. A large number of students also attended, the subject being one of great local interest as well as of general importance from the standpoint of chemical technology, botany and economics.

Mr. Walker in addressing the meeting referred to the vast progress that had taken place in Boston in regard to the manufacture of chocolate during the last fifty years and mentioned that when the industry first started nearly all their cacao came from Trinidad and Venezuela. Mr. Walker considered that Trinidad cacao was at present inferior to what it had been in the past owing to neglect of cultivation; but he emphasized the fact that there would be no difficulty in America in regaining the old reputation and better prices if only Trinidad would use her splendid resources of soil and climate to the best advantage and produce a sufficiently large quantity of good estate's cacao, a quantity which in his own words would be large enough so as "not to get lost in the shuffle of the mixing room."

Mr. Majani pointed out that most of the best Trinidad cacao went to England and the Continent but agreed that general improvement in quantity and quality was what was needed.

Continuing Mr. Walker said the great feature about Trinidad cacao was the splendid flavour and nutritive qualities of the cacao itself. The butter fat content of the Trinidad bean was not on the average high. Here it was explained that the butter fat is in many ways a very important part of cacao commercially. The Trinidad annual cacao crop, said Mr. Walker totalled on an average 60,000,000 lbs. which when dealt with in the factory produced 12,000,000 lbs. waste, 19,200,000 lbs. butter at 30 cents per lb., and 28,800,000 lbs. of cacao powder at 60 cents per lb. The importance of the waste and the butter is therefore apparent.

Regarding competitive cacaos, Mr. Walker said fermented Accras had been for years improving steadily and what was more important, perhaps, Lagos (Nigerian) cacao had made as much improvement in three years as had taken the Gold Coast ten. The importance of soil and climate was emphasized by Professor Ashby and discussion in connection with grades of cacao from Ecuador made this very evident. Mr. Walker thought that good Trinidad cacao could easily find its way into manufacture and fill the gap which was now steadily growing wider owing to disease and other causes at Guayaquil. During his remarks Mr. Walker pointed out further that cacao powder was principally consumed in the United States in connection with ice creams and soda fountains and there was no likelihood of there being either abstinence or prohibition in regard to these national institutions. Mr. Walker suggested that Trinidad cacao should be made right into Trinidad chocolate and sold as such. No other chocolate was better. One factory in Boston uses nearly as much cacao every year as is produced during the same period by Trinidad and if Trinidad could sell to such a factory the result would mean permanent prosperity for what Mr. Walker considered one of the most fertile islands in the world.

IMPORTANCE OF CHEMICAL TECHNOLOGY.

PROFESSOR F. HARDY.

Tropical agriculture differs materially from temperate agriculture in the nature of its end products. Whereas the interest of the plant-grower in temperate countries generally ends with the successful harvesting of grain, root and fodder grasses that comprise his main staples, that of the tropical planter must be extended beyond the mere growing of plants to the technological details of preparing from them diverse products that frequently require considerable skill in their elaboration. It is because of the intrinsic nature of his articles of merchandise, and because of the geographical position of his plantations, that the tropical agriculturist has these additional responsibilities forced upon him.

The sap of the sugar cane begins to alter in composition immediately the stems are severed, its content of sucrose rapidly decreasing. Steps must therefore at once be taken to recover the main component from the harvested plant. It would be disastrous, as well as costly, to transport the raw material to sugar factories located near the main markets or centres of consumption. The fruit of cacao or of coffee is perishable; it must be fermented and dried before it can safely be shipped for further treatment. Limes and lemons quickly rot after ripening; their juices must therefore be extracted soon after reaping, if losses of citric acid are to be avoided. Their rind cells must also immediately be punctured to save the essential oils from deterioration. Ripe palm nuts are bulky, and contain fatty oils that tend to become rancid. To lessen cost of transport, and to secure the best quality of fat, it is necessary to express these oils, or at least to desiccate the pulp, soon after the nuts have been gathered. Rubber latex, when intended as a source of crepe rubber, must be quickly coagulated to separate the valueless components which would unnecessarily increase freightage and introduce difficulties of handling.

These typical examples of the treatments that must be given to tropical crops in order to render their special products marketable, illustrate the two main objects of chemical technology as applied to tropical agriculture. They are, firstly, to prevent spontaneous loss or deterioration of the main product for which any particular crop is grown, and secondly, to reduce bulk by the elimination of valueless components, in order to lessen cost of transport.

The means whereby these objects are attained varies greatly with the different kinds of tropical plant products, but we may conveniently group the main operations under the following headings: (1) mechanical expression of plant saps, (2) mechanical separation of fibres, (3) dehydration or desiccation, (4) crystallization (5) distillation and (6) extraction by solvents.

The mechanical expression of plant saps is usually a straightforward process, requiring only some type of roller machinery. It is entirely a problem for the engineer. So also is the separation of vegetable fibres, such as cotton and hemp, by ginning or beating.

Dehydration and crystallization are much troublesome operations, because, during the removal of water from plants or plant saps, certain kinds of chemical and physical changes are likely to occur, that frequently result in the destruction of the very substance which it is intended to preserve. In order to understand the nature of these changes, as a pre-requisite to their control or elimination, exact knowledge of the properties of the numerous and varied chemical substances present in plants must be obtained. It is here that physical and chemical investigations have done much to aid the technologist in elaborating efficient methods for the isolation of desirable components of plants. Perhaps no more striking example of this fact can be quoted than the case of the manufacture of sugar from sugar cane juice. Little advance was made beyond the primitive methods of treatment, until chemists adequately demonstrated the importance of neutralizing the natural acidity of cane juice before evaporating, and of carefully removing the various colloidal substances present therein before attempting to crystallize out the sugar. It can safely be stated that even now we know very little about the complex relationships that exist between the various components of sugar cane juice, and that much further research is needed if additional progress in sugar manufacture is to be made. Furthermore, when it be realized that of all tropical plant products, none has received so much attention as cane sugar, one must admit that great scope lies before the investigator in the bio-chemistry and physics of tropical plants.

Distillation is the method used for separating substances of different volatility, and has long been employed in the manufacture of certain plant products, notably alcohol and essential oils. The process is entirely physical, and is governed by certain laws which have been very completely studied in the laboratory. A thorough understanding of these laws is necessary for the correct designing of distillation apparatus, and for the attainment of economical working.

Most vegetable drugs are obtained by extraction with solvents from the plants that contain them. The extraction process must be carefully elaborated and great attention paid to the employment of the right kind of solvent. The specific properties of the substance it is desired to extract must therefore be accurately investigated, for the different drug compounds vary greatly in behaviour.

Sufficient has been written to demonstrate the fundamental bearing of chemistry and physics on the problems relating to the technology of tropical plant products. Indeed, it is patent that these problems do not greatly differ in kind

from those that confront the chemical engineer in other industries. To be successful, the technologist merely has to apply certain well-established principles of science, with due consideration of the composition and properties of the substances with which he is dealing. This, however, is not all. He has also carefully to choose and co-ordinate suitable large-scale apparatus, and to employ only those methods that are economically sound. The economic factor must never be left out of account. Management is just as important in the tropical plant products factory as in the field aspects of agriculture. A perusal of the immense amount of obsolete scientific and patent literature that has sprung up around the subject of chemical technology, will indicate the extremely exacting nature of this selective economic factor. Many technologists go so far as to maintain that management should be the main concern of the manufacturer. This cannot of course be entirely true, because the technologist has to handle materials as well as men, and a knowledge of the behaviour of the one is just as important for success as a knowledge of the behaviour of the other.

Many possible tropical plant products industries have remained undeveloped, or have failed to materialize soon after initiation, on account of a lack of appreciation on the part of tropical agriculturists of the importance of the fundamental sciences in chemical technology. The plant-grower who has no understanding of the profundities of physical and chemical processes, who beholds with a certain apprehension the vast amount of accumulated knowledge of the properties and behaviour of substances, is seldom willing to exploit crop plants with which he is unfamiliar, or to extend his technological activities to new ventures.

It should therefore be one of the main objects of a complete education for tropical agriculturists to remove this unfamiliarity with the fundamental facts and principles of chemical technology. Whilst it is recognised that the tropical agriculturist cannot hope to become a specialist both in the business of crop growing and also in that of plant products manufacture, much can be done by preliminary training to remove the lack of co-ordination between these two divergent types of activity. What has been accomplished in the sugar industry might profitably be extended to other tropical plant industries. Indeed, rapid strides have already been made in this direction in California, where citrus growers are working in complete accord with the manufacturers of certain by-products, under the guidance of the Director and Staff of the Laboratory of Fruit and Vegetable Chemistry recently established at Los Angeles by the United States Department of Agriculture. This is a line of development and organization which might well be followed up more generally to the benefit of tropical industry in many countries.

PROBLEM OF WEED CONTROL.

PROFESSOR J. SYDNEY DASH.

[*Substance of an address on "Weeds and their Control" delivered before the Tacarigua Agricultural Society on March* 20, 1924.]

An exact definition of a weed, as you will be aware, is hard to give, since plants are often useful in one way and harmful in another. Perhaps the commonest definition we have of a weed is a plant out of place. Two others may be cited: (1) a plant which interferes with the growth of the crop to which a field is temporarily devoted; (2) any injurious, troublesome or unsightly plant that is at the same time useless or comparatively so.

Generally speaking, weeds fall into three classes, based on their life history; annuals, which complete their growth and mature seeds the first year; biennials, which mature their seed the second year; and perennials, which may produce seeds every year and also survive by special adaptations of the root system, such as storage organs or rootstocks. In the tropics, while such a classification may hold true in the botanical sense, on account of the climatic conditions there is such a rapid succession of generations that the terms annual, biennial and perennial in regard to weeds have not much significance to the practical mind. Perhaps the terms noxious and harmful, differing only in degree of meaning, represent more clearly the class of weed with which one is dealing; the former referring to those weeds which are difficult to get rid of owing to their method of growth and survival and which seem to persist in spite of all efforts to eradicate them, and the latter to those which are much easier to dispose of. In the first class, common examples in the West Indies would be nut grass, devil's grass (Bermuda grass) and French weed or pond grass. The so-called "gamlotte" of the cacao orchard might also very well be included. In the second, such weeds as the pigweeds (spinach) and others of that class would fall. These grow only from seeds and not from pieces of root, nodes of the stem, bulbs, &c., as in the case of the other group.

Weeds are disseminated in various ways; crop seed, manure, irrigation and run off water, wind, transportation, animals, special mechanisms of plants for weed dispersal, and lastly man himself, are among the most important agencies by which weeds are spread. Dealing first with crop seed, it may be remarked that the methods of harvesting grain crops in the tropics, mostly by manual labour prevent much dissemination from this source. In the case of manure, this is perhaps one of the principal channels through which weeds are disseminated from field to field under tropical conditions. Weeds find their way to the pens, and because their seeds do not easily lose vitality but on the contrary possess remarkable powers of longevity, may remain in manure for a long period of time and germinate freely when suitable conditions arise. Because of this characteristic of weed seeds, it is frequently observed that fields

brought under cultivation after a long period has elapsed may develop an extraordinary crop of weeds unless control measures are promptly taken. The importance of run-off water in weed dissemination may be called to mind by the fact that the sides of drains are often the first places in a field to be invaded by weeds. The part played by wind is equally obvious; light seeds are blown from place to place and certain types of seeds have special attachments which make for their easy spread by wind. In this way fields soon become infested from waste places, roadsides and vacant patches which harbour weeds.

Weeds are robbers in the sense that they deprive cultivated plants of nitrates and other plant nutrients; as parasites when actually growing on other plants, they rob their host of its elaborated food. They also shade plants and take up valuable space. Weeds harbour plant diseases and pests in this connection, cotton stainer, froghopper and mosaic disease of sugar-cane are three familiar examples of maladies which are harboured by weeds. Again, some weeds are poisonous to livestock and not infrequently occasion loss in this way. Such are some of the more direct ways in which weeds inflict serious losses on agriculturists. To these could be added: hindrance often caused in harvesting operations; loss of time and money in removal; injury to roots of cultivated plants by secretion of toxic substances.

On the other hand, weeds may have something to their credit. They may act as soil indicators; certain weeds show when acidity is present, others when lime is present, as is the case with leguminous weeds. Some again indicate poor drainage conditions, while others are associated with poor or infertile soil. Certain weeds have medicinal properties. Lastly, weeds may sometimes be used to suppress other useless or unsightly plants.

Coming now to the question of control, it is important that the problem be approached from two standpoints, namely, prevention and eradication. Prevention is of course primary and fundamental. The agriculturist must seek to prevent by every possible means the entrance of weeds into his land. Clean manure, clean pastures, clean ditches and clean hedgerows are of paramount importance. The trouble is that this part of the programme never receives serious attention, hence one often hears the remark that it is impossible to keep cultivated lands free from weeds. There is no need to be discouraged, for no weed exists which it is not possible somehow to control. Persistency of effort is necessary, and the agriculturist who is always on the lookout to prevent fresh introductions to his soil will be fully rewarded. In this connection, the practice of buying manure is not to be commended, unless the source is well known, for it frequently contains objectionable weed refuse. In the making of pen manure much care is necessary where brushings and weed growth are used as litter, such material should be cut before seeds have formed, or else burnt. One point that should be particularly emphasized is that it is impossible to clean up in a few years the weed accumulations of twenty-five or more, and this unfortunately is not borne in mind very often in the purchase of property; weedy land should be scrutinized as carefully as weedy stock for both will cost to put them in order.

Eradication has for its object the getting rid of weeds after they have gained an entrance. Just as in other problems, nature's methods often provide a clue to treatment, so in the present case it would be well to note what nature teaches. What are the conditions of vegetation in a virgin forest? Do we not find that there is little or no undergrowth of bush or weed, and what is the reason? It is the dense shade which makes for the comparative absence of vegetation on the surface of the soil. In forests of second growth and abandoned agricultural land, the conditions are altogether different and there one finds a mass of undergrowth of all descriptions. Thus, the practice of smothering weeds by shade has arisen, and some form of it is in use in practically all agricultural countries. One class of weeds, however, which is generally unaffected by high shade is that which includes the grasses, so many of which are our worst pests. Because of the entrance of grass into their cleared patches, squatters or wandering people like some of the Mexican types, are constantly moving on, converting what was once virgin soil into abandoned grass land, which can only be made productive again by intensive methods of cultivation. While then most herbaceous weeds are easily kept down, under ordinary plantation conditions, it is the grass that gives rise to the greatest concern and anxiety. Cover crops of the leguminous type producing dense low shade are very effective against all classes of weeds if a good stand can be obtained. They are economical weed fighters and serve the purpose of soil improvers as well. The planter can ill afford to do without them where soil and climatic conditions are favourable. Under orchard conditions, it is possible to use these green mulches up to a point where the development of the trees will no longer permit of their growth, and then cutlassing and in some cases cultivation may be resorted to. In this connection discing has not received the attention in the West Indies it deserves. The growing of a cover crop lends itself well to part of a definite system where the intercropping of young orchards is practised. A thick straw mulch where available also has a smothering effect on weed growth, lessens evaporation, and supplies much organic matter on decaying. Its efficiency like the green mulch depends on its thickness and frequency of renewal.

The whole problem of weed control in tropical orchard conditions, however, could I think be very profitably investigated from an entirely new angle; the question as to whether an optimum weed flora might not be satisfactorily established has so far received insufficient attention. Could not an effort be made to distinguish between what types of weeds should be persistently eradicated and

what types one could profitably leave. In this connection a large number of our leguminous weeds might conceivably prove to be some of our best friends. On the other hand, it has been shown that Para grass in coconut orchards reduces considerably the yield of nuts. Comparative studies of this kind are greatly needed in the economics of permanent crop agriculture.

Dealing now with field or arable crops; in the case of sugar, the practice of close planting and long ratooning where conditions are favourable is regarded as an economic method of dealing with the weed problem. Here again it is the shade that is sought after, but there is a limit to the usefulness of the method. On the other hand, the interposing of a long seasoned cover crop between successive crops of cane cannot be too strongly recommended. While serving the purpose of weed destroyers they are most useful too in bringing thrown out fields back to a good state of tilth. It is surprising to find that greater use is not made of this class of crops in Trinidad, where the climatic conditions are usually very suited to their growth, and where too they do not seem to be so liable to the ravages of insect pests as they are in many of the other islands. At the Imperial College last year we had occasion to bring into cultivation a certain amount of abandoned land. It was tilled, then ridged and furrowed in the ordinary way and sown with Bengal beans at the commencement of the rainy season. The seeds germinated well, although the land was rather rough, and the plants made vigorous growth. Soon a thick cover was obtained and in October part of this was turned in. The remainder occupied the land until January when it seeded. Bananas and sugar-cane were planted in the turned-in area, and since then we have experienced little or no trouble from weeds, not even excepting nut grass. The precaution is taken, however, of keeping the hedgerows and ditches clean to prevent the entrance of weeds from outside sources. My experience has been the same in Guadeloupe in handling weedy lands. Now these cover crops do not act like magic, that is to say, planted in unbroken land and in impropitious weather, little or no help can be expected from them in the matter of weed control. In this same order of ideas, there is the practice developed in Hawaii and latterly to some extent in Australia of using paper mulches to keep down weeds and retain moisture. The paper is spread over the surface of the fields, the cane shoots are usually strong enough to pierce the paper, but the weeds are smothered. This may seem an expensive method but it must be remembered that labour is very high in those countries and the paper is cheaply made from unused bagasse of the mills.

In spite of everything we may do, under ordinary conditions, a certain amount of weeding and cultivation whether by hand or implements, will still be necessary. Its efficiency, however, greatly depends on the time and frequency of the operations, notably in the early stages. In this connection, some knowledge of the habits and root system particularly of the weed one is dealing with is of great value. It has been said the more one cultivates the more weeds one sees. To a certain extent this is true, so long as weed seeds are present. By cultivation we induce germination and then by cultivating again soon after, the young plantlets are destroyed. In fighting an opponent, it is the natural thing to strike him in the most vulnerable spot, so in fighting weeds, the same practice must be followed if we are to succeed. The young stages are the vulnerable spots in the weeds' armour and there must be no relaxation of effort in getting after them at that time. My experience is that it is far more economical in the long run to cultivate often and early than to give spasmodic attention to the eradication of weeds. While cognisant of the difficulties which often beset the ordinary agriculturist, I do not hesitate to say that it is just here that his good judgment and management usually break down.

That weeding and cultivating pays has been proved over and over, and a few figures may be quoted in support of this. In Hawaii, it was found in some experiments with fertilizers that where weeding was not done and fertilizers applied, the yield of cane was 21·3 tons per acre. Both weeding and fertilizer gave a yield of 29·7 tons; uncontrolled weeds and no fertilizer, 13·19 tons; while weeding without fertilizer produced 20·38 tons. These figures represent the average of a considerable number of trials, and it will be noticed that there is little difference between the first (uncontrolled with fertilizer) and the last (controlled without fertilizer), showing that in this case weeding was equivalent to manuring and that it is uneconomical to apply fertilizer to weedy land.

By implemental tillage in St. Croix, it has been found possible to reduce the labour cost of growing cane by approximately 50 per cent., at the same time getting an increase of five or six tons of cane per acre, which was mainly attributed to the fact that the weeds were efficiently and moreover economically controlled. Implemental tillage is gradually assuming greater importance in Trinidad and British Guiana in connection with sugar production and it will be interesting to follow the results of this work from the standpoint of weed control. There is increasing activity on the part of implement manufacturers in designing implements for eradicating the underground portions of noxious weeds. Such implements would be most useful in the West Indies for nut grass and Bermuda grass. In the latter case, unless it is forked out by hand and removed, it will continue to spread and become almost impossible to eradicate.

In conclusion, I should like to point out that co-operation is greatly needed among agriculturists to solve many of their problems, of which it will be conceded that weed control is not the least. Community action should be aimed at in a matter of this kind so that pressure may be brought to bear on those who persistently infest their neighbours by harbouring bad weeds on their lands.

GEOGRAPHICAL REVIEWS.

(1) *The Journal of the Royal Geographical Society* (February, 1924): "The People of British North Borneo."

(2) *The National Geographic Magazine* (February, 1924): "The Hawaiian Islands."

(3) *The National Geographic Magazine* (March, 1924): "Australia's Wild Wonderland."

(1) British North Borneo, as a whole, is very sparsely populated, and this is especially so says Professor Max Reinhard in the case of its south-east coast. The men of the principal rivers are Tidungs and Banyers both immigrants from Dutch Borneo. The latter are a troublesome and ever-fighting race but prove to be the best of junglemen, except for the Dayaks, who come to the country occasionally in search of Damar and wild rubber. As in many parts of the tropics the Chinese storekeeper abounds. Cash is an unknown and superfluous commodity in their trade, the Chinaman being content with heavy loads of Damar and rubber in exchange for trifling petty wares and sweet-meats.

(2) In Dr. Grosvenor's magnificent description of Hawaii the cosmopolitan character of the Hawaiian population is clearly and accurately discussed. Not only in this respect but also physically the Hawaiian Islands bears close resemblances to the Lesser Antilles of the Caribbean in respect of their size and dispersion. The native Hawaiians are a handsome musical race. They enjoy practically a sub-tropical climate which has not had an enervating influence. The present remarkable industrial development of the Islands has been the result of American influence and is manifested chiefly in respect of sugar estates and pine apple cultivations with their attendant factories. There is a remarkably wide range of rainfall in Hawaii varying from 2½ ins. per annum in one place to 476 inches per annum in another. Irrigation is a feature of the dry plains and one plantation uses as much water as the city of San Francisco. Sugar cane which requires half a ton of water to make one ton of sugar is transferred to the mills by flumes—aqueducts on trestles of wood.

(3) Along the coast of north-western Australia, which is tropical, there are Asiatics employed in the pearl fisheries under a special clause in the White Australian Act. These people, mostly Montgomery Islanders of Malayan origin are described with very remarkable photographs by Mr. M. P. Greenwood Adams. These natives are big seven-foot men adorned by big skin blisters over their backs—cicatrices produced by scratching the skin with a sharp shell and rubbing in mud. These people catch big sharks and turtles and fish for the mammal known as the Gugong. There are some coconuts grown and cattle and pigs raised along the coast, but the natives of this region are typically sea-faring people.

MANAGEMENT.

(*By Callisthenes, in "The Times."*)

There is a good deal of misunderstanding, pardonable it may be, in some quarters, regarding the importance and even the functions of management in large businesses. Management may be described, briefly, as a science that is based on sound and accurate knowledge and expressed through personality. Like all occupations that call for great results, it has its own technique, and requires its own long and diligent apprenticeship. And this technique can never be thoroughly mastered unless the apprenticeship is gifted with, or can acquire, imagination, breadth of outlook, and that distillation of other qualities known as judgment.

Only Army men can fully appreciate what is meant by generalship; only sailors understand the manifold virtues which are summed up in the word seamanship; politicians recognise more easily than others the qualities of political leadership. And so it may be a little difficult to make plain to those who are not actually business men the full significance of the words "good management." Perhaps the safest summary we can give is that it represents, like generalship and seamanship, the capacity to do the best thing in every conceivable situation.

There often seems something a little elusive in the mental make-up of the successful manager, just as there seems an instinct in the way in which a shepherd controls his flock that is not possessed by ordinary people. He has a knack of getting others to put their best into their work. One of his chief uses to his organization is his unerring judgment of men, and the precision with which he prevents square pegs lodging into round holes. He can inspire others till they can see with his own splendid vision, and a quiet word of praise from him is more effective than a panegyric from other people.

There may be business where those who occupy the executive positions are content to regard themselves as the recipients of good fortune, entitled by virtue of their posts to have as easy a time as circumstances will allow. They sometimes forget that their position carries with it very definite responsibilities, not only to those under them but to the community at large, who have a right to expect that every business in its midst shall be one of its assets. And the extent to which any business may be regarded as a national asset depends almost entirely upon the attitude—and aptitude—of its management.

There is a grand tradition of our Navy "the price of Admiralty is eternal vigilance." The Commerce of this country is as essential to its welfare and safety as the Navy, and it would be well if there were a tradition in every business organization to the effect that "the price of successful management is eternal vigilance."

THE TROPICAL WORLD.

MAURITIUS.

Dr. Tempany's report on the working of the Co-operative Credit Societies discloses the fact that troublous times have been experienced in this regard in Mauritius as they have in the West Indies and elsewhere, mainly as the result of the demoralising effect of the post-war boom and subsequent slump. In Mauritius the striking feature of the co-operative credit societies is, according to Dr. Tempany, who is Registrar, the hunger for dividends; and notwithstanding the fact that great pains have been taken to explain to members that the Societies do not exist for the purpose of paying dividends but for the provision of capital on easy terms to small cultivators, yet each year the demand for dividends is practically certain to be raised in some quarters. In some few Societies in Mauritius there exist shareholders who have invested relatively large sums in shares in the hope of obtaining dividends, but these amounts are gradually being reduced and the shares either redeemed or transferred to other members. It is interesting to remark here that outside of India, agricultural credit societies on the Raffeisen system, regulated and supported by Government were first started in the British tropics by the Honourable C. Gidéon Murray, Administrator of St. Vincent, in 1913.

BRITISH GUIANA.

It will by now be generally known that British Guiana has generously decided to make a material contribution to the annual revenue of the Imperial College of Tropical Agriculture. As a condition for this British Guiana students will be admitted to the College at the usual reduced fees applicable to contributing colonies and doubtless British Guiana will in due course be directly represented on the Governing Body, and in a year or two give special assistance in support of the College research and training in sugar technology which will commence as soon as the model factory is erected at St. Augustine. In addition to College support, the Colony, we are glad to learn, is likely to find £7,000 a year for a far-reaching forest policy with a view to developing her own hinterland. This will be a trifling expenditure as compared with the ultimate financial returns, and is the outcome of the report by the Committee of the Empire Forestry Conference which was held last year in Canada. The Committee comprised Major R. D. Furse, D.S.O., Assistant Private Secretary (appointments) Colonial Office, Chairman; Professor R. S. Troup, C.I.E., Professor of Forestry, Oxford University and formerly of the Indian Forest Service; Mr. G. E. Cubitt, Conservator of Forests, Straits Settlements and Federated Malay States; and Mr. J. R. Ainslie, Senior Conservator of Forests, Nigeria, formerly of the Ceylon Forest Service. The Committee took advantage of the presence of Mr. L. S. Hohenkerk the representative of British Guiana, and in many ways it is to be regretted that it was not possible to recruit the assistance of Mr. C. Hummel, Forestry Officer, British Honduras formerly of the Federated Malay States Forest Service who has done such excellent work these last three years in the British territory which has in many respects conditions similar to those obtaining in British Guiana. At all events the essential point is that the Committee's report has had what has been so greatly needed, namely an educative effect in making it clear in British Guiana what is meant by technical forestry in contradistinction to timber cutting. Until recently the prevailing ignorance as to the economics of forestry and forestry policy has in the West Indies, been little short of appalling.

BRAZIL.

In noticing Mr. Charles W. Domville-Fife's new book dealing with the wild tribes of the Amazon "The Saturday Review" justly calls attention to the fact that journeys through the Amazon forests involve conditions to which much African exploration has been merely child's play. The sole paths through the jungle are the waterways, and it is only at considerable risk that the explorer can go even a mile or two away from the rivers. The native tribes are inhospitable and this distaste for strangers has been intensified by the evil usage which many of them have in the forest encountered at the hands of rubber-gatherers, whose history includes some of the most painful chapters in the commercial history of agricultural exploitation. Among the most interesting pages in Mr. Domville-Fife's book appear to be those which describe the activities of the Brazilian Government's Indian Service, which is endeavouring to improve the sociological conditions of these wild races. In the night time interpreters attached to each section climb the loftiest trees on the verge of unknown regions and shout messages of friendship through a megaphone for the benefit of the natives who lie "trembling in their primitive huts." The next step is to establish what is called an "Attraction Post" where crude gifts are laid out and connected to the headquarters of the Service section by a trail of beads, knives and mirrors. By such means a number of the wildest tribes have been "toled in." Subsequent action on the part of the service is not recorded, though it would appear that judging by the rate of growth of Brazilian agricultural industries the country must need all the labour it can possibly secure. By last mail we received a letter from Mr. B. G. C. Bolland, M.A., Director of the Estacas Experimental de Algodas (Cotton Experiment Station) at Ceara who has promised to supply all published information on agricultural matters in the province, the striking feature of which, at present, consists in the large Nile-like irrigation works constructed or in process of construction, to allow of the cultivation of cotton on a highly productive and good-quality basis.

KENYA.

The Uasin Gishu Railway which leaves the Uganda line at Nakuru and runs to Eldoret, was formally opened by the Governor of the Colony (Sir Robert Corydon) on February 11, last. The line is to be continued from Eldoret to the Busoga Railway which runs close to the Nile just before the river enters Lake Victoria Nyanza. There are to be other extensions also, mainly for the development of the Uganda cotton fields. The line just opened, says a report to the "Times," brings into communication with the outer world probably the largest and best area suitable for Europeans and for general agriculture in Kenya and marks the first definite step in the economic advancement of the Colony. The new line has just been opened for goods traffic and will be opened for passenger traffic, probably, in July next.

THE PHILIPPINES.

A seemingly striking anomaly in the recent report of the United States Tariff Commission in regard to sugar costs in American territories, is the absence of any figures having reference to the Philippines. This is referred to editorially in a recent issue of "Facts about Sugar" and data are given that have been derived from the Philippine Sugar Association. In 1922 the manufacturing cost at one Philippine mill is given as 0·92 cent per lb. and at another as 0·87 cent as compared with 0·69 cent (average, apparently) in Cuba and 1·12 cent in Hawaii. Owing to differing methods of paying for canes the cost of cane to central factories is lower in the Philippines than in other American territories being 0·92 and 1·07 cents respectively, for the two mills cited, as against 1·71 cents in Hawaii and 1·38 cents in Cuba. The transportation of sugar to the United States is more costly for the Philippines, likewise are fixed charges as calculated. The total cost of production for the season mentioned was 3·06 cents per lb. for one Philippine mill and 3·20 cents for the other as compared with 3·93 cents for Hawaii and 2·49 cents for Cuba. Naturally in considering these figures one has to be careful in respect of the items which they cover, and in the case of the Philippine figures it must be remembered that the total cost is not the true statistical average because it is not the weighted mean. As regards general agricultural affairs, the Philippines have, with recently advancing prices for produce, recovered from that somewhat rather severe set-back which is referred to in the annual report of the Bureau of Agriculture for 1922. A feature of agricultural investigation work and development on the part of this Bureau is the work done in connection with livestock. The experiments regarding the stock feeding of locally grown products may be mentioned, and special attention drawn to the experiments with copra meal and to the inclusion of oyster shell and calcium phosphate to remedy that deficiency in minerals which is characteristic of tropical pastures.

TANGANYIKA.

In connection with the references on this page to railway developments in Kenya, it is only emphasizing the present phenomenal progress in the direction of transport development in Africa to record that the Empire Cotton Growing Corporation has suggested the possibility of tapping the Mwanza area in Tanganyika by means of a railway to Tobora, on the Tanganyika Central Railway, and that this suggestion, together with another relating to the opening up of the potentially rich cotton fields of north-west Nigeria has been referred by the Colonial Office for examination by the local governments concerned. It is not fully realised in the more settled and established parts of the tropical Empire how great are the developments in Africa. As regards education and research, information is to hand that definite proposals are under way to revivify and extend the activities of the Amani Institute in Tanganyika which was established as a scientific research station by the Germans before the war.

CEYLON.

The Honourable Mr. E. J. Hayward moved in Council some time ago to the effect that a Committee should be appointed by the Government to enqure into and report on the traffic in Colombo in rubbishy teas or substitutes for tea, whether for local consumption or for purposes of export. It appears that the tea trade in Ceylon is in other hands than those who have the general interest of the Colony at heart, and it is likely that the motion, which was accepted, will effect a very valuable piece of reform. Another matter of legislative interest is the second reading of the new Plant Pest Bill, a clause in which prohibits the introduction into the Colony of living specimens of any insect or invertebrate animal not already known to exist in the Island, unless permission has been granted by the Director of Agriculture or other authorities. While not coming within the scope of agriculture, attention may be called to the work done in connection with the marine industries in Ceylon and to the fact that experiments started with culture pearls are not being continued, the Government reason being lack of money for the purpose. Concerning horticulture, some agitation has been in operation to arouse greater enthusiasm in railway station gardens, the standard of which has of late fallen off. This is a matter which is given considerable attention in Trinidad where both the Department of Agriculture and the Government Railway Department have taken active steps to encourage this means of increasing the attractiveness of the Colony. In connection with livestock in Ceylon, Mr. W. Crawford, M.R.C.V.S., has been appointed by the Secretary of State for the Colonies to the post of Assistant Veterinary Surgeon. In addition several prominent agriculturists are giving attention to the improvement of dairy cattle which we shall have occasion to refer to in a subsequent issue.

ESTATE ACCOUNTANCY.

PROFESSOR W. R. DUNLOP.

[*The following is the first of a series of articles on a subject which, hitherto, has not received the scientific thought and attention it deserves. This, the introductory article, deals chiefly with the general idea of scientific accountancy in its application to tropical estates and their administration. In subsequent articles will be explained principles and methods in detail. Sample accounts based on actual estate figures will be included.*]

Introduction.—For many years a great deal of money has been spent and a great deal of time has been devoted in connection with the chemical, entomological, mycological and botanical problems of tropical agriculture, but little systematic attention has been given either by investigators or administrators to the problems of that side of tropical plant industry which is commonly regarded as the private concern of the estate proprietor or manager, namely the actual management of the estate. The attitude has rather been that the manager can always carry on efficiently provided he is fed with panaceas for his troubles with Nature, and that apart from that, little is to be gained by seeking the advice of agricultural and scientific experts. This attitude, in the tropics, still persists to a very large extent and is retarding progress materially. In the first place the ownership and management of a property is not merely a private matter. Ownership and management involve responsibilities to the community as well as to the individual. And in any case the attitude that the investigator or educationist cannot assist management has been entirely broken down in England and in the United States by the work during recent years of the Institute for Research in Agricultural Economics under Orwin at Oxford, and that of the Bureau of Agricultural Economics of the United States Department of Agriculture under Taylor. There is no rational reason why similar work should not be systematically carried on in British tropical Colonies. As to the nature of this work, while industrial psychology will undoubtedly figure prominently as part of tropical estate investigations in the future, the present and most fundamental requirement especially in regard to education is a fuller and more practical appreciation of the subject of scientific accountancy.

Universal Application.—Although estates throughout the tropics vary enormously in size, geographical circumstances, systems of management and in the nature of what they produce; although they range from the large sugar estates of Cuba and the rubber Companies of the East, down through the ordinary 500-acre estate privately owned and managed until we come to the native peasant grower of cotton or cacao, yet, the scientific principles of accountancy and statistics apply to all. It is of course obvious that the actual working system must vary in the case of different concerns and that generally speaking the larger the estate the greater will be the complexity in respect of detail. It is essential to realise however that scientific accountancy applies to conditions of peasant proprietorship, and that there is undoubtedly great scope before the application of the principles in this direction through the instrumentality of Agricultural Credit Societies and Departments of Agriculture.

Present Situation:—In the course of my investigations in connection with the subject of accountancy and statistics, carried on both at Trinidad and London it has become increasingly evident that while estate managers and proprietors admit there is much room for improvement and reform, such progress is not likely to be effected until (*a*) there is closer understanding and agreement amongst all concerned in respect of general principles and methods, and until (*b*) there is greater confidence in the practical utility and public service of scientific accountancy as distinct from its academic interest.

Method of Approaching the Subject.—It may prove simplest to approach the subject by asking ourselves a number of important financial and statistical questions, and for the reader, if he be familiar with tropical estate management or administration, to judge for himself whether these questions are likely to be answered or satisfied by most existing systems of estate accountancy. Naturally these questions are intended to have reference to the medium and large estates rather than to very small ones.

Leading Questions.—(1) Two (let us say) sugar factories A and B, situated within a few miles of each other deliver sugar f.o.b. nearest port at the cost of £12 and £15 per ton respectively. What exactly is this three pounds per ton difference due to? Is it due to higher efficiency in the factory, and if so, in what departments of the factory? Is it due to differences in transport? Is it due to higher production of cane per acre? Is it due to lower cost per acre? Does the lower cost of £12 necessarily signify better management? (2) Irrespective of whether the estate produces sugar, rubber, or coffee, &c., how much capital has been sunk in the estate and factory and in what specific directions? (3) What rates of interest has this capital been yielding? How does this compare with other estates of the same kind in the same district, in other districts, and in other countries? What proportion of the capital is unproductive? (4) Is the cost of production per acre and per unit quantity in different fields known at all accurately? Is the estate accurately surveyed and is there a plan? To what extent do the fields vary in their topography? (5) Do the estate records over past years combined with similar records on other estates in the district show what is the normal expenditure (maintenance) cost per acre on a permanent crop estate preferably in man-hours per acre in respect of individual fields? (6) In the case of permanent crops such

as cacao, coconuts and rubber is depreciation made a fixed annual charge and if so how much and on what biological basis? (7) Do the estate records give accurate statistical information concerning building and machinery depreciation and insurance risks? (8) Do the labourers always receive full payment for every unit of task work they do? Is it possible for there to be leakages in this direction? On the other hand do labourers always effect what they are paid for? Do the accounts serve as a guide in this respect? (9) Does the estate know its average labourers family budget and how this compares with other estates in the same and in other countries? (10) Does the estate know its profit per acre cultivated and per labourer employed? (11) Are the working animals and tractor machinery on an estate credited with what they do and the various fields, &c., debited proportionately with the cost of these services of power? (12) In the case of light railways on estates with more than one crop is the railway credited with cost of transport and each crop product debited proportionately? (13) In what manner is supervision and such items as hospital charges distributed amongst the departments of the estate? How do profits per cent. overhead charges compare with similar ratios for other estates? (14) Is there any financial record of unexhausted fertility such as drainage, manure, &c., carried forward at the end of the financial year? (15) Are labourers and staff perquisities properly credited at cost value? (16) Are the charges against profit and loss as complete as the law will allow in respect of income tax? On the other hand, are there any charges made against current expenditure which are really capital outlay? (17) Can the average estate supply costs including marketing costs for political and economic purposes as is demanded by the United States of America Sugar Tariff Commission? (18) Are the productive (fully yielding) acreages of the planted areas in the case of orchard crops known accurately? (19) Do the estate accounts yield any insight into the loss occasioned by pests and diseases, storms, &c., (20) Do the estate records evince any scientific attempt to correlate crop yield with rainfall? Or in the case of irrigation, is the cost accounted for accurately? (21) Does it pay better to grow rice and corn on the estate or to purchase them? Does it pay to manufacture manure or to purchase it? (22) What is the cost of growing a smother-crop or green-dressing? (23) Is the stores account accurately inventoried, depreciated and credited with withdrawals and the receiving accounts debited? (24) Does the estate know what it loses in respect of compound interest due to delay in the effecting of sales of produce, and are there statistics to show the relative advantages and disadvantages of selling to local merchants *versus* exporting? (25) What is the cost of molasses, megass, rubber seeds, coir, fibre and other by-products? (26) Has the owner of the estate received money, services or produce which he has failed to debit his private account and credit capital account? (27) Do the accounts draw a clear distinction between profit and loss and cash? Can the estate show a proper balance sheet which would be accepted by accountants and financiers as sound? (28) In the factory preparation of estate products for marketing, could anything extra be done in respect of the selection of cacao, coffee, &c., which the users in Northern countries do at a far higher labour cost than would be necessary locally on the estates? (29) Do the accounts clearly exhibit the amounts and effects of encumbrances, such as mortgages? (30) Is any pedigree value attached to special plant or animal types, as for example in a district growing a pure strain of high yielding and high quality cotton? (31) Does the estate possess adequate statistics to show the relation between extent of acreage, and capital and labour requirements, and profits to be expected? (32) Does the estate accountancy system include the preparation of annual estimates based on statistical costs? (33) Are statistics available as to the natural yield of the crops or individual trees cultivated?

Uniformity, Continuity and Purpose.—To answer these questions the importance of which to any industry will be at once obvious, necessitates the existence of a continuous and uniform cost financial accountancy and statistical system based upon fundamental principles. Most estates of considerable size keep very accurate and detailed records of expenditure. But no records however accurate and detailed unless kept on the basis of principles with a view to leading up to definite conclusions will ever supply the answers to the foregoing questions.

Complexity.—Scientific accountancy, especially in tropical agriculture where we are mostly dealing with a single crop at a time, is not complicated and difficult once the principles have been grasped and a system has been started with a reasonably good staff (in the case of a large estate) which is capable of taking an intelligent interest. On the ordinary sized estate of say 500 acres privately owned and managed, the system in a simple form can be applied with little extra expense and demand upon the time of the manager. What is needed in most cases is simply slight modification and extension in the daily records (pay list principally) and the provision of information in regard to valuation, depreciation, allocation of charges, &c., and a thorough acquintance with principles and methods. This naturally requires thought and study in the initial stages. Writers who say otherwise are likely to mislead their readers.

Importance of Agriculture, Factory Technology, &c.,—I should like to emphasize that a good practical knowledge of agriculture and factory technology and marketing, *i.e.*: of estate management is essential in scientific accountancy. Unless this practical knowlwdge is blended and co-ordinated with scientific accountancy the purposes aimed at cannot possibly be achieved. It follows that a good manager possessing sound

agronomic knowledge is already more than half way towards being a good estate accountant. A knowledge of chemistry, biology, physics and mathematics also assist very materially and will have to constitute part of the training of the professional estate accountant in the future. This however is looking rather far ahead and need not concern us in respect of practical requirements of the moment.

Nature of Accountancy.—Scientific accountancy can be conveniently considered under three heads (*a*) Financial accountancy, (*b*) Cost accountancy, (*c*) Statistics. In practice these three classes are inseparable in a properly run productive industry, and the combination forms the best system of accountancy; but for instructional purposes, it is generally found convenient in preliminary studies to draw a distinction in order to separate out the fundamentals that characterise each class. Financial accountancy is mainly concerned with the conduct of a business (and we regard an estate as a business) from what may be called the banker's point of view. The profit and loss balance, the balance sheet showing the difference between assets and liabilities (capital) are the principal features involved. Sound financial accountancy involves double-entry book keeping, the proper handing of credit transactions and an insight into the question of security and valuations for the most part from the market or selling point of view. Generally speaking financial accountancy though it checks expenditure does not analyse the working of the business. It is more in the nature of an accurate description of the financial position of the business at any date. Questions (16), (27) and (29) above involve pure financial accountancy. Cost accountancy, on the other hand, deals as the term suggests with costs. The outlook is inexorably from the cost point of view, and is quite different to the ordinary outlook in connection with financial accountancy. Market prices for instance are of no concern in cost accountancy; assets are valued at what they have cost to date and the business is regarded as a number of persons each corresponding to a different section of the business (accounts) each of which is debited with what it receives from the others and from the owner (capital). In cost accountancy on an estate the developing produce is regarded as being on a sort of economic journey as it were along a railway line, the accumulating cost being known at every station until the produce finally reaches the terminus. Questions (4) and (25) above involve pure cost accountancy. The following additional questions serve as a good test whereby a manager can decide definitely whether his present system of accountancy affords him accurate cost figures: Does the method of estimated costs of supplies and materials insure that all that have been bought have actually gone into production? Does the method provide for the actual losses of materials in process of production or by reason of theft or negligence? Does the system insure that the wages paid as productive wages are all accounted for in the production with due provision for idle time, &c.? Does the system distribute the overhead expense on to the production in correct proportion to the operations involved? In regard to the statistical aspect of accountancy, which was given as the third heading of classification it will be sufficient here to observe that statistics is the science of large numbers, or as it is sometimes called, the science of averages, and concerns the computation of descriptive averages and investigations in regard to relationships (correlation), trends and variation. A comprehensive and scientific accountancy system involves these elements of statistical method. Estate accounts must be used to supply averages and statistical constants and standards, to aid intelligent administration by Government and by the local industry as a whole to guide it and adjust it in its struggle with possible lower-cost competitors overseas. Questions (20), (31) and (33) above involve pure statistical accountancy.

Broad View Needed.—While it will be shown by means of practical examples in subsequent articles that scientific accountancy is of real practical value on the estate, it is necessary however to take a broad point of view in regard to it. Individual estate economy and control is not the only consideration. Proper accountancy gives moral structure to any industry; it tends to generate in each individual business a sense of pride, efficiency, responsibility and service. It is essential to recognise that the principles of accountancy involves moral as well as economic and mathematical laws. A sound country has sound accountancy from the national budget down to the individual budget of the poorest peasant. The British Empire, and especially the Mother Country, possesses a high reputation in this respect.

Directional Control.—As already stated, most large estates possess very efficient methods of recording expenditure, but there is not evidence to show that these records are kept and utilised according to scientific principles except in the case of a few of the more progressive companies. The point I wish to emphasize here is that no new system of accountancy of a scientific character can be effectively introduced by an employé. The principles and general methods and purpose must be initiated and enforced by the supreme financial head of a business, and unless this director understands the ideas involved no scientific accountancy staff however expert individually will make the system a real success. It is essential that there should be no break between cost and financial accounting, that is between the relationship of capital to current expenditure. In the case of the owner-manager the preservation of this continuity is simple. It is less so on estates directed overseas by companies or syndicates because of the hiatus between direction, the Agency and the management; but it only needs organization to put it on a sounder basis.

Educational Aspects.—The proper training of young men who wish to become estate managers cannot be satisfactorily carried out in Colleges unless there are actual estate records and accounts continuously coming in for study and statistical examination. In this regard it is no exaggeration to say that the estates in Trinidad must regard themselves as an integral part of the Imperial College of Tropical Agriculture if that institution is to be really successful in regard to the training of overseers and managers. The importance of this idea was fully brought out in Sir Daniel Hill's article which appeared in the February issue of this Journal. A satisfactory arrangement in regard to the above matter would involve a necessity for greater uniformity in the methods of keeping estate accounts. My investigations lead me to think there would be little difficulty in putting this into practice. Indeed to some extent as has already been done.

Good and Bad Times.—The fortunes of those engaged in agriculture, especially tropical agriculture, are notoriously subject to what is called good and bad times—the result of favourable or unfavourable seasons, high or low market prices, political changes and other at present uncontrollable and unforeseeable circumstances. In the case of many estates, especially those which are privately owned, this has not infrequently had the cumulative effect of inducing a kind of happy-go-lucky philosophy which in the long run is economically unsound and diametrically opposed to the canons of good accountancy. In the first place such a philosophy tends to operate against the adoption of a sound accountancy system, since in good times the manager can point to high profits as a reason for the non-necessity of a scientific system; while when times are bad there is a tendency to put forward the absence of profit as an excuse for not adopting a system which may incur some extra expenditure. As a matter of fact where such expenditure is necessary it is in the first instance to be regarded as capital outlay, but the principal consideration is that scientific accountancy is needed to enforce financial stability in respect of good and bad times, through the establishment in connection with it of a reserve fund to meet unfavourable circumstances. Companies registered under the Companies' Act have this reserve fund and it is important that the policy should be adopted in smaller concerns. There is no question that when times are good exceedingly large profits are made by tropical estates and there is no legitimate financial excuse for not making some provision for the future, especially in regard to bad seasons. It is possible that it might be sound policy to enforce the formation of a reserve by Law in some Colonies. This might be done in connection with income tax administration which itself requires accurate cost accountancy on estates. As already noted good and bad times are produced by trends and fluctuations in market prices, rainfall, &c., these, it may be observed, are capable of being investigated mathematically, and statistical research has already achieved interesting and important results in these connections. This aspect of statistics does not come directly within the range of our present subject of estate accountancy, but it is important to know of it. The point to emphasize here is the fact that because agricultural industry is subject to fluctuations in fortune, it makes it all the more important to adopt a scientific accountancy system.

Estate Attitude.—Most estates, at any rate in Trinidad, appear to exhibit either apathy or apprehension in regard to changing their systems of accountancy. This is largely due to lack of understanding, but there is also one very real reason on the larger estates, namely the difficulty of getting trained and responsible assistants. In this respect it should be possible for the Imperial College of Tropical Agriculture to be of assistance provided estates are capable of regarding such book-keepers as highly trained and scientific and be prepared to pay them better salaries than is at present considered adequate for ordinary clerical book-keeping.

Competition.—In regard to what I have called the statistical aspects of accountancy both in respect of administration and education, there may arise the consideration as to whether estates would be wise to disclose the workings of their businesses. There is a good deal of controversy going on on this matter amongst the rubber companies of the East whose costs are regularly published in the newspapers. The Rubber Shareholders Association of London which after all represents a very strong body of opinion, is not only in favour of cost comparisons but is also urging that uniform methods of arriving at these costs shall be introduced on estates in the Federated Malay States and Ceylon. It has to be realised of course that in putting an estate on the market for sale it might not be desirable from a commercial point of view for its cost and finance to be public property. It might not always be desirable in the case of public companies for shareholders to know too much either. But I believe the time will come when shareholders will insist on scientific cost and financial statements and prospective buyers likewise. For the present however any objections in this regard could be overcome by estates supplying their cost-financial data to a central statistical authority confidentially. It seems to me that there is nothing to be gained and much to be lost by one estate in any particular country wishing to hide its efficiency or inefficiency from another. Of course if higher efficiency is due to a secret technical process as might easily exist in the case of the chemical technological processes of an estate factory, the position would be different. But generally speaking from the management aspect there should be no desire for an efficient

estate to want to see inefficiency in another. Maximum production with minimum cost is best for all concerned, for this increased production means increased wealth and therefore less relative taxation. Competition exists very often amongst estates in regard to labour supply and as regards small farmers such as those who supply canes to central factories. But if one estate gets the labour it requires while another one in the same neighbourhood does not the reason for it in practice is not very difficult to find. The labour itself can give the information whether statistics are made available or not. Frequently such differences are due to the personality of the manager, and since personality cannot at present be imitated to any large extent, there is no serious reason for keeping it secret. It may be mentioned however that intangible as personality appears to be it has a distinct financial value and is or should be accounted for in the salary which the manager receives. Competition from the point of view of over-supplying the world market is seldom significant from the standpoint of the individual estate. Over-supplying generally involves consideration in terms of countries rather than of estates, which again introduces the statistical and political aspect of accountancy as is to be seen in the case of the rubber industry of the East.

Comparison Indispensible.—It will have been realised from all that has been said that the idea of comparison is at the heart of scientific accounting both in respect of the accounts of a single estate year by year and of the industry as a whole. So also is the idea of managerial analysis and control an essential feature—points which will be brought out more lucidly in a later article.

Accuracy.—Lastly it must be emphasized that scientific accountancy like all scientific measurment and explanation can never be perfectly accurate—only approximate. The sort of accountancy that accounts for every half-penny and "works like clockwork," as a large coconut proprietor in Trinidad recently stated his did—is generally unscientific and to be distrusted. One is not dealing merely with cash in accountancy, but with seasons, services and management and care of assets—which include such strikingly different things as the soil, trees, buildings, livestock and machinery, concerning the inherent scientific nature of which the average estate proprietor knows little or nothing. In cost-financial accountancy we can only hope to be approximate, and luckily approximations enable us to make a system just as simple or as complex as we please. But while we can always be scientific we can never hope to be accurate. We cannot, as Professor Bowley says in his "Elements of Statistics," hope to be like the *Modern Traveller*—

> "Who knew the weather to a T,
> The longitude to a degree,
> The latitude exactly."

(*To be continued.*)

PLANT PATHOLOGY.

A Case of a Simple Cure.—A discovery of much interest which may have important economic consequences has been reported recently from Java by Dr. G. Wilbrink (*Archief voor de Suikerindustrie in Ned. Ind.* No. 1, 1923). She had found that the gum disease of sugar cane in Java was caused by a bacterium which was killed in liquid culture by a short exposure to a temperature slightly above 50° C. (122° F.) The symptoms of this disease resemble in some respects those of the notorious Sereh a disease which threatened the stability of the sugar industry in Java in the 80's of last century and the cause of which baffled investigators for forty years. Both diseases are transmitted in cuttings from affected canes and it was in the hope of finding some ready means of distinguishing between them that Dr. Wilbrink subjected infected cuttings to a hot water treatment at a temperature slightly above the thermal death-point of the bacterium causing Gum Disease. It was hoped that the immersion would kill that organism in the cuttings and result in healthy shoots developing when they were planted. It was not believed, on the other hand, that the treatment would be effective against Sereh because that disease has been regarded of recent years as in the class of leptonecroses like leafroll of the potato the causative agent of which survives a temperature that kills the eyes of the tuber. The results of the experiments, however did not bear out these anticipations. Although the eyes of healthy cuttings sprouted after immersion in hot water for 30 minutes at 50°-52°C. (122°-126°F.) the eyes of gum diseased cuttings failed to grow. The eyes of Sereh diseased cuttings subjected to the same treatment sprouted and gave rise to shoots showing no symptoms of the disease. These were allowed to grow on for five months and untreated cuttings from them gave rise to entirely healthy plants. The experiments were repeated with Sereh-diseased cuttings from a number of cane varieties with the same result—the hot water treatment effected a complete cure. The best results were obtained by a preliminary immersion for 30 minutes at 45°C. (113°F.) followed by exposure at 50°-52°C. for 30 minutes. Immersion for 30 minutes at a temperature not exceeding 50°C. was not curative and 15 minutes at 50°-52° was only partially curative. The treatment lowered germination, but from two-thirds to three-quarters of the cutting sprouted.

Dr. Wilbrink does not believe that this method of controlling Sereh will be adopted readily by the industry owing to the technical difficulties involved in the treatment of large quantities of cuttings by hot water within a narrow and carefully regulated range of temperature but also because planters in Java have for many years been in possession of an effective though costly method of control which has developed into an independent business of considerable magnitude. This refers to the production of disease-free cuttings in a series of nurseries in the highlands for export to the factory

cultivations in the lowlands. She expects however that it may be adopted ultimately, probably in a modified form, owing to the great saving in cost.

She points out also that the cause of the disease can hardly be a heat resistant "virus" but rather some organism of low thermal death-point. A number of known plant pathogenic bacteria are killed in liquid culture at a temperature of 50°-52° maintained for ten minutes. The hot water treatment failed to cure cuttings infected with Mosaic disease but killed scale insects (mealy bugs) and the larvae of borers and gave promise of being effective against Red Rot.

S. F. ASHBY.

EMPIRE COTTON.

Among the recent and welcome additions to cotton growing literature is "The Cotton Farmer" the pioneer journal on the subject in Australia. In the issue for January 1, is given Part II of "The Cotton Industry Act of 1923" (Queensland) the main point of which is the prohibition of ratooning. Other items in the Journal including an article on community cotton growing, are indicative of a sound outlook in respect of producing even standards of cotton, and the lively, and essentially practical character of "The Cotton Farmer" should do much to assist profitable cotton-growing in Australian territory, more especially Queensland.

THE CINEMA IN AGRICULTURE.

Agriculture is usually the last field of human activity to benefit by epoch-making inventions. Yet to-day the aeroplane is used in combatting the cotton boll weevil in the southern United States and in locating forest fires; the motor has entered into agriculture and revolutionized country social life and cultivation of the soil in all parts of the world. Even the gramaphone has improved conditions and may even take the place of personal instruction in Agricultural Colleges if the world ever demands teaching limited to the mere imparting of information.

The greatest scope for invention in respect of education—especially in the direction of teaching agricultural geography—lies in the more extended use of the cinema. A good example of what can be achieved in this direction in respect of tropical agriculture and industry was to be seen last year at a private exhibition given by Lord Leverhulme, head of the great firm of Lever Brothers in London. Those who had the privilege of attending this function were enabled to obtain a striking impression of conditions in Nigeria, both in regard to the palm oil industry, tin-mining and lumbering. A striking characteristic to those who are accustomed to New World conditions was the large quantity of labour employed in transport, *e.g.*, in the manipulation of surf boats, in the heading of bags of palm kernels and in the hauling of mahogany. The towns, for example Lagos, seemed stereotyped in architectural structure with plain wooden houses and bungalows. Kano, however, the most ancient town in Africa is unique with mud walls and flat roofs and camels and arab steeds in the streets. The turkey buzzard is much in evidence in the African towns and is the natural scavenger. One of Nigeria's finest engineering features is the railway construction and in the course of the picture shown by Lord Leverhulme there appeared tin-mining scenes in which immensely powerful water "monitors" are used, and later one of the British Cotton Growing Association's ginneries that have produced such good results in Africa.

The cinema is being used extensively in connection with the British Empire Exhibition and a collection of such films bearing on tropical agriculture, would (together with appliances) be valuable adjuncts to the equipment of the Imperial College of Tropical Agriculture.

COLLEGE NEWS.

ATHLETIC SPORTS.—Good form and much keenness was shown in the Easter Term Sports held on Saturday, March 15, in the College fields. The total number of entries were twenty-three. The principal results were as follows: 100 Yards, H. C. Vilain, first (10 4-5 secs.), H. Ryan, second; 440 yards, H. C. Vilain, first (62 secs.), N. S. Haig, second; 220 Yards, H. C. Vilain, first (24 3-5 secs.) N. S. Haig, second; ½ mile, N. S. Haig first, (2 mins. 26 2-5 secs.), R. Parga, second; Long Jump, H. C. Vilain, first (18 ft. 4 ins.), R. V. Grey, second; High Jump, B. G. Montserin, first (4 feet 8½ ins.), V. I. Mulloon, second; Three-legged race, H. C. Vilain and B. G. Montserin, first, G. W. Nye and N. S. Haig, second; Obstacle Race, P. D. R. Bovell, first, R. Parga, second, and A. B. Killick, third; Tug-of-War, won by Second Year Diploma Students.

The judges at the meeting were Sir Francis Watts, Professor H. A. Ballou, and Mr. A. G. Howell. Professors Ashby and Hardy officiated as Time-keepers, Mr. C. T. Watts as Starter, Mr. L. A. Corbin as Master of the Ceremonies and Mr. N. S. Haig as Hon. Secretary.

A large number of visitors attended mainly comprised of the relatives and friends of the Students and of the College Staff. The donations and prizes, which were of an attractive and substantial character were kindly given away by Lady Watts. Considering it was the first of its kind the meeting is to be regarded as having been in every way a most successful effort and one that will extend as the College grows. It is scarcely necessary to add that great credit is due to those who were responsible for the general organization and arrangements on this occasion.

The results of the tennis tournament, now being played, will be published shortly.

TREND OF THE MARKETS.

(*The notes below are based principally upon running charts of the prices of the basic grades and upon general statistical information gleaned from contemporary publications and cablegrams and are intended to be a record of movements. An attempt is made, where possible, to indicate the market outlook at the time of going to press, but no responsibility for the accuracy and subsequent truth of such observations is assumed. Unless otherwise stated the prices quoted are spot, London*).

SUGAR.—According to reports on March 17, raw sugar declined to the basis of 6.91 cents duty paid, for Cubans and 6.78 for Porto Rican under more liberal offerings. Lamborn's report for February 29, points to a general strengthening of sugar prices. The Cuban crop was at its peak during March with useful falls of rain, and good outlook for a normal crop.

COTTON.—Middling Upland (New York) has been fluctuating around 16.5 cents with a slight tendency to rise. The decline in cotton prices to present levels took place in the middle of February last.

CACAO.—Trinidad cacao in New York has been higher at 10½ c. and 10¼ Accra 7½ to 7⅝. Arriba 12⅝ and Machala 12 cents. These two latter are Ecuador grades. The recent strengthening of the cacao market has been due to the failure of a large firm of brokers in Amsterdam and to unfavourable outlook in regard to Ecuador crop.

COFFEE.—The trend of Santos in London has been steadily upward. Spot prices on February 6, 78*s*. per cwt.

TEA.—The Indian Average continues to fluctuate around 18⅛*d*. per lb. Everything points to satisfactory prices being maintained for some time to come if estates pay due attention to quality rather than quantity.

SISAL.—Prime sisal continues to rise steadily the quotations for February 6, being in the neighbourhood of £41 a ton.

RUBBER.—The U.S.A. appears to be coming into the rubber market again to meet the increasing tyre consumption and the dullness which has characterised the New York market is changing. Unconfirmed rumours that Dutch growers are joining in restriction served to advance spot ribs to 25⅞ cents New York recently. Significant news arrives from Java reporting purchases of rubber estates by Americans, one planted area being 15,000 acres. Prices offered exceed those obtainable by flotation in London.

RICE.—Burmese continues steady around £17 10*s*. per ton. Rice quotations have taken three ascending stairway levels since last August.

COPRA.—Good copra continues steady around £33 5*s*. per ton having risen to this point from £26 a ton last mid-August.

VEGETABLE OILS.—Palm kernel, crude, 44*s*. 6*d*., palm oil, softs, 39*s*. hards, 38*s*. 6*d*., Ceylon coconut oil 48*s*. 6*d*. c.i.f. Cotton seed oil (common edible) 52*s*. (mid-February).

CITRUS PRODUCTS.—Lime juice: London stocks of concentrated at February 14 were cleared at £22 to £21 per pipe *ex* wharf, whilst the bulk of the Dominica crop has been sold at £22 c.i.f. for shipment. Distilled lime oil dearer at 4*s*. 6*d*. Orange oil steady at 9*s*.

There was a total of approximately 2,225,000 acres planted in Hevea rubber in British Malaya at the end of 1921, of which 1,316,831 acres were in bearing. As there has been very little if any planting since 1921, this total holds good for the present time though certain acreages will have advanced from the non-bearing to the bearing stage. In Ceylon at the end of 1922 there were 404,375 planted acres of which 390,000 were in bearing. In Southern India and Burma there were 124,000 planted acres, 61,086 of which were producing. Altogether the British Empire has about 2,850,000 acres under rubber of which 2,830,000 are in bearing.

Unusually heavy rains in Santa Clara and Camaguey Provinces on February 6 damaged the Cuban tobacco crop to an extent which is believed to be considerable. The heaviest losses were near San Diego and del Valle in the Santa Clara Province and at Majagua, Camaguey.

The Brazilian Ministry of Agriculture has estimated the 1923-24 sugar crop for the entire country at 644,410 metric tons placing Brazil in fourth place as a producer of cane sugar, preceded in order by Cuba, India and Java. The 1921-22 crop is said to have reached 500,000 metric tons and the 1922-23 crop is placed at 605,280 metric tons by the same department.

Brazilian exports of sugar amounted to 252,111 metric tons in 1922, according to the official Brazilian statistics, and when it is considered that in 1910 these sugar shipments amounted to but 58,323 metric tons, the extent to which the industry has developed in recent years is evident. During the first eight months of 1923 sugar exports reached a total of 105,029 metric tons. Domestic consumption is calculated at approximately 350,000 metric tons per annum.

The estimated world production of cane and beet sugar ("International Sugar Journal") for the 1923-24 crop is 19,145,500 tons compared with 17,947,528 for 1922-23. This is an estimated increase of 1,197,972 tons. The greatest increases have taken place in respect of European beet but there have also been increases in the American cane-growing territories.

The serious condition of the fruit production industry in Queensland has found expression in the Fruit Marketing Organization Act, of which the principal intention is to protect the producer from the middlemen. The administration of the Act will be assisted by local organizations comprising growers of bananas pineapples and citrus fruit principally.

The approximate estimate of cotton grown in new fields in the British Empire (bales of 400 lbs.) was 105,800 bales in 1920, 165,100 in 1921 and 103,400 for 1922.